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(54) Method of detecting transmission error in disaster prevention supervisory system

(57) During data transmission between a receiver and each of a plurality of terminal devices (Q_1–Q_n) in a disaster prevention supervisory system, the receiver sends calling data including address data for specifying a specific terminal device to the side of the terminal devices in a transmission error detection mode. The receiver also causes the terminal device specified by the address data to return error detection response data including self-address data and check data at a current level previously defined. When the current level (6) of the check data in the error detection response data received by the receiver is higher than the level previously defined due to the response of a plurality of terminal devices, it is decided that an abnormality is present in the terminal device of the address specified by the calling data.

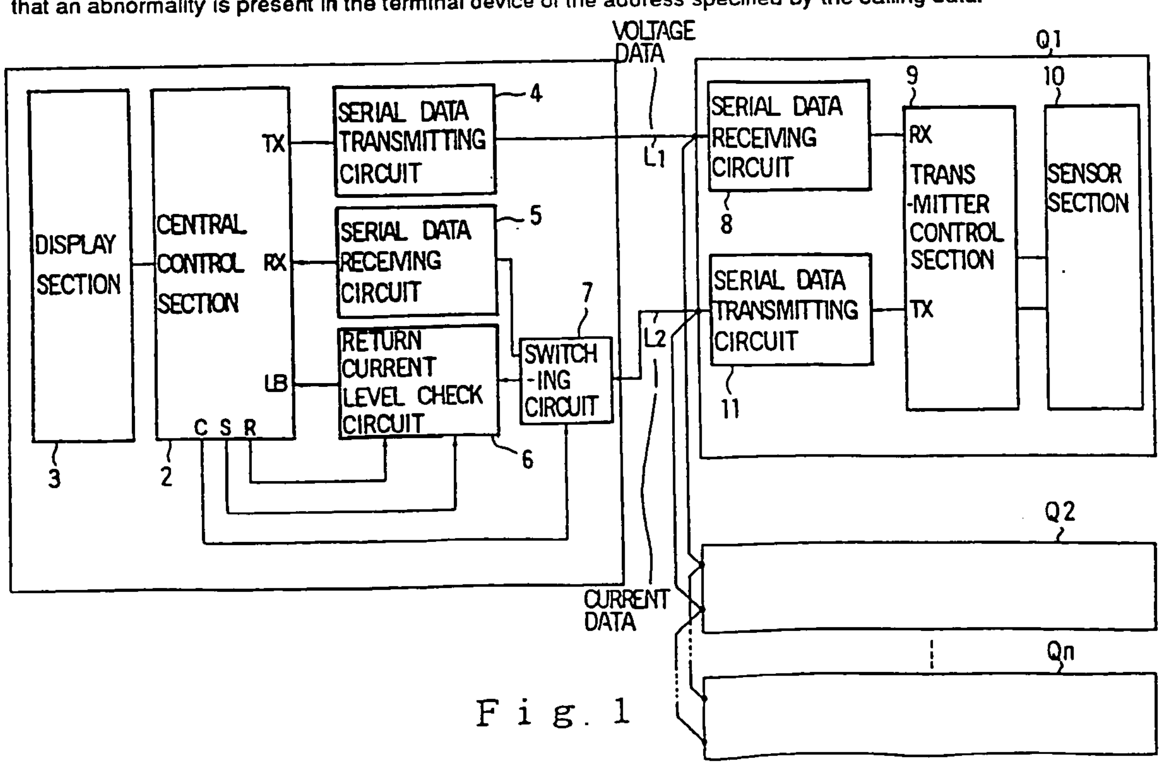

Fig. 1

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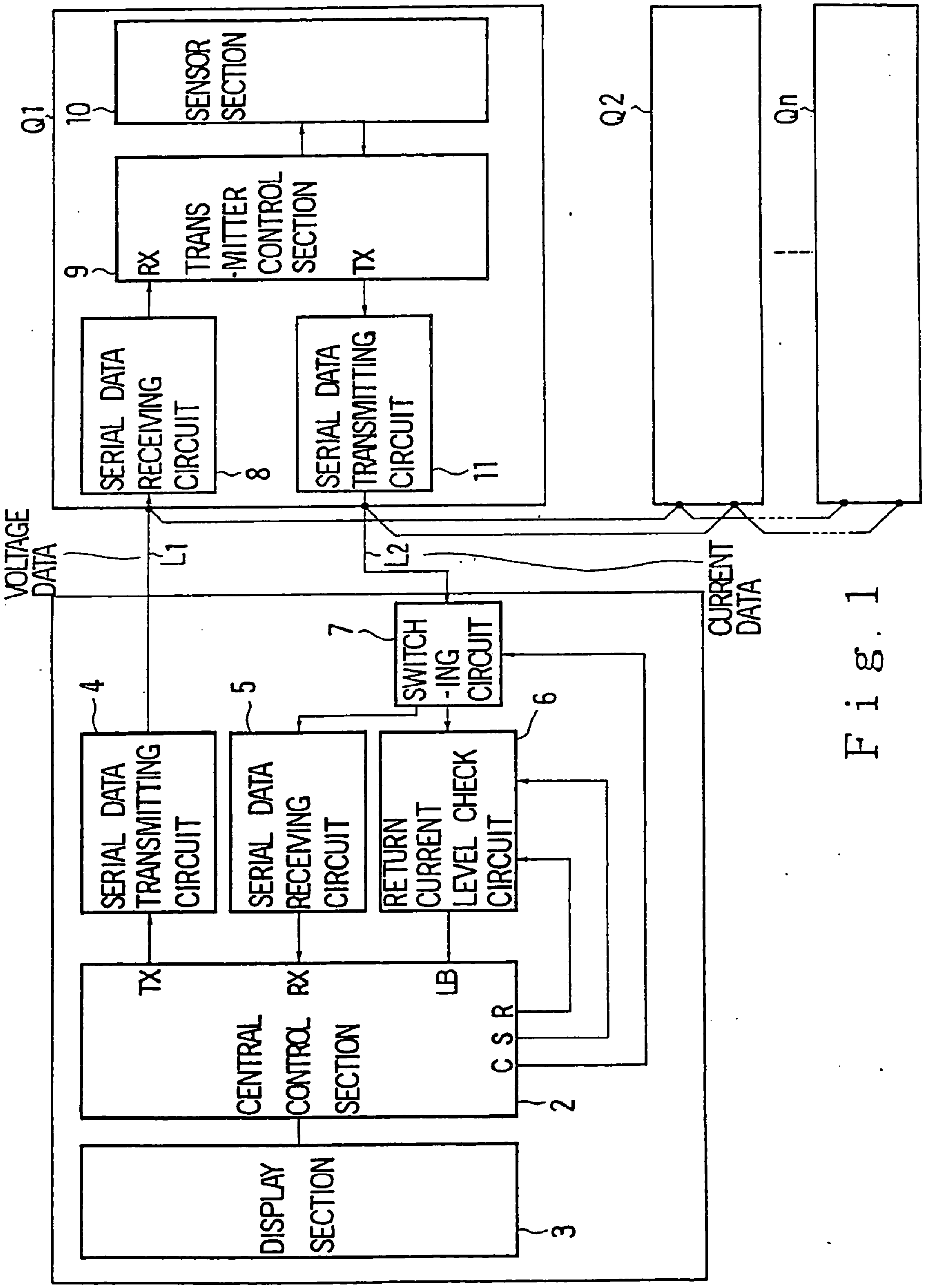

Q1
10
SENSOR SECTION
9
RX
TRANS -MITTER CONTROL SECTION
TX
SERIAL DATA RECEIVING CIRCUIT
8
SERIAL DATA TRANSMITTING CIRCUIT
11
Q2
Qn
VOLTAGE DATA
L1
L2
CURRENT DATA
7
SWITCH -ING CIRCUIT
4
SERIAL DATA TRANSMITTING CIRCUIT
5
SERIAL DATA RECEIVING CIRCUIT
6
RETURN CURRENT LEVEL CHECK CIRCUIT
TX
RX
LB
C S R
CENTRAL CONTROL SECTION
2
DISPLAY SECTION
3

Fig. 1

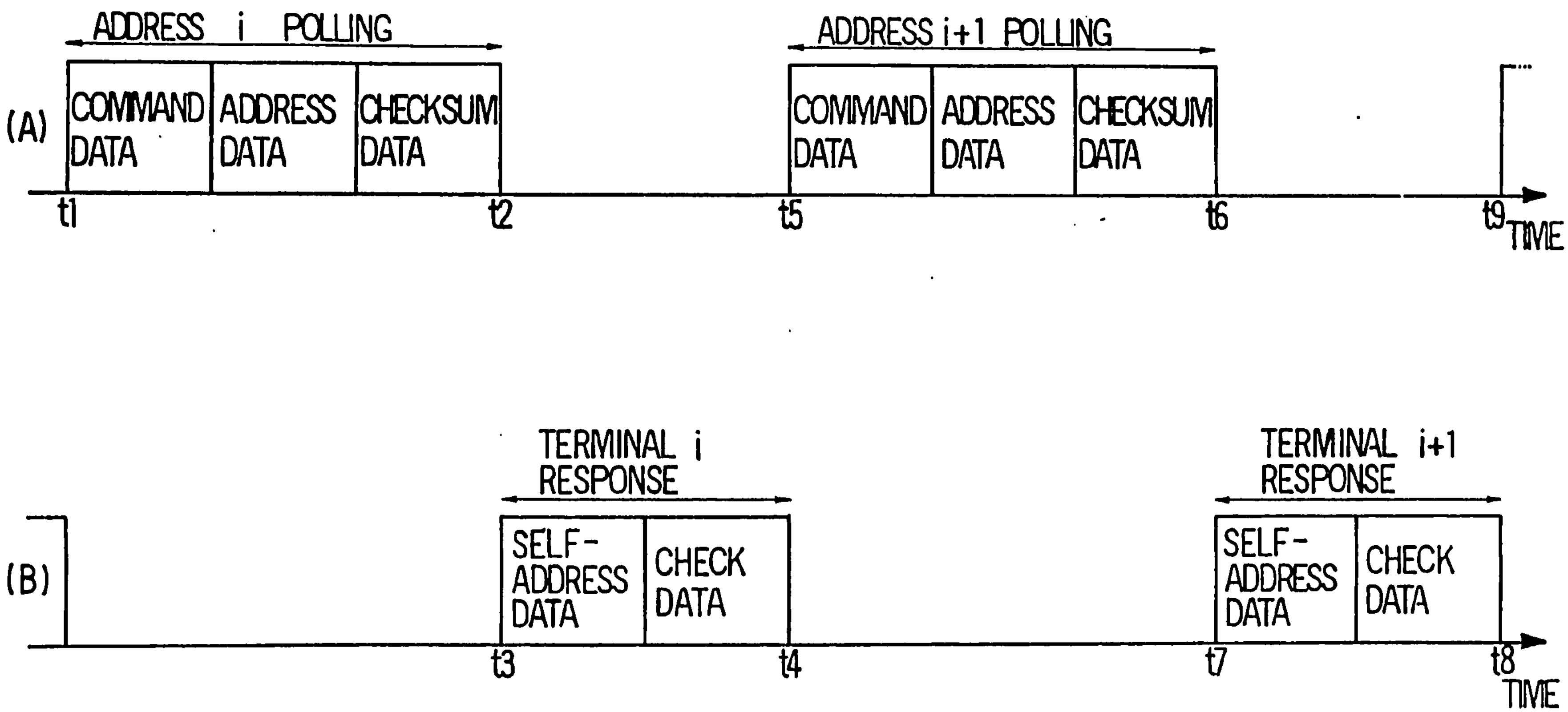

ADDRESS i POLLING
COMMAND DATA
ADDRESS DATA
CHECKSUM DATA
ADDRESS i+1 POLLING
(A)
t1
t2
t5
t6
t9
TIME
TERMINAL i RESPONSE
SELF-ADDRESS DATA
CHECK DATA
TERMINAL i+1 RESPONSE
(B)
t3
t4
t7
t8

Fig. 2

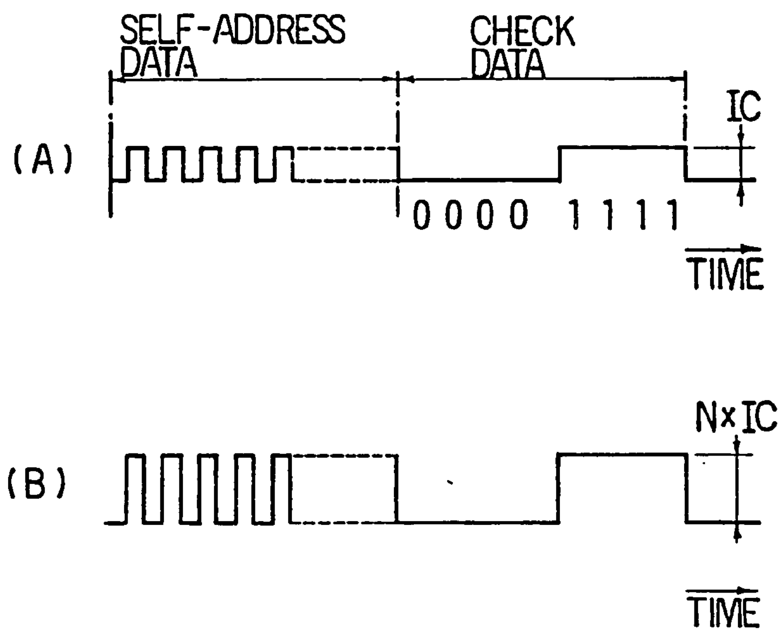


Fig. 3

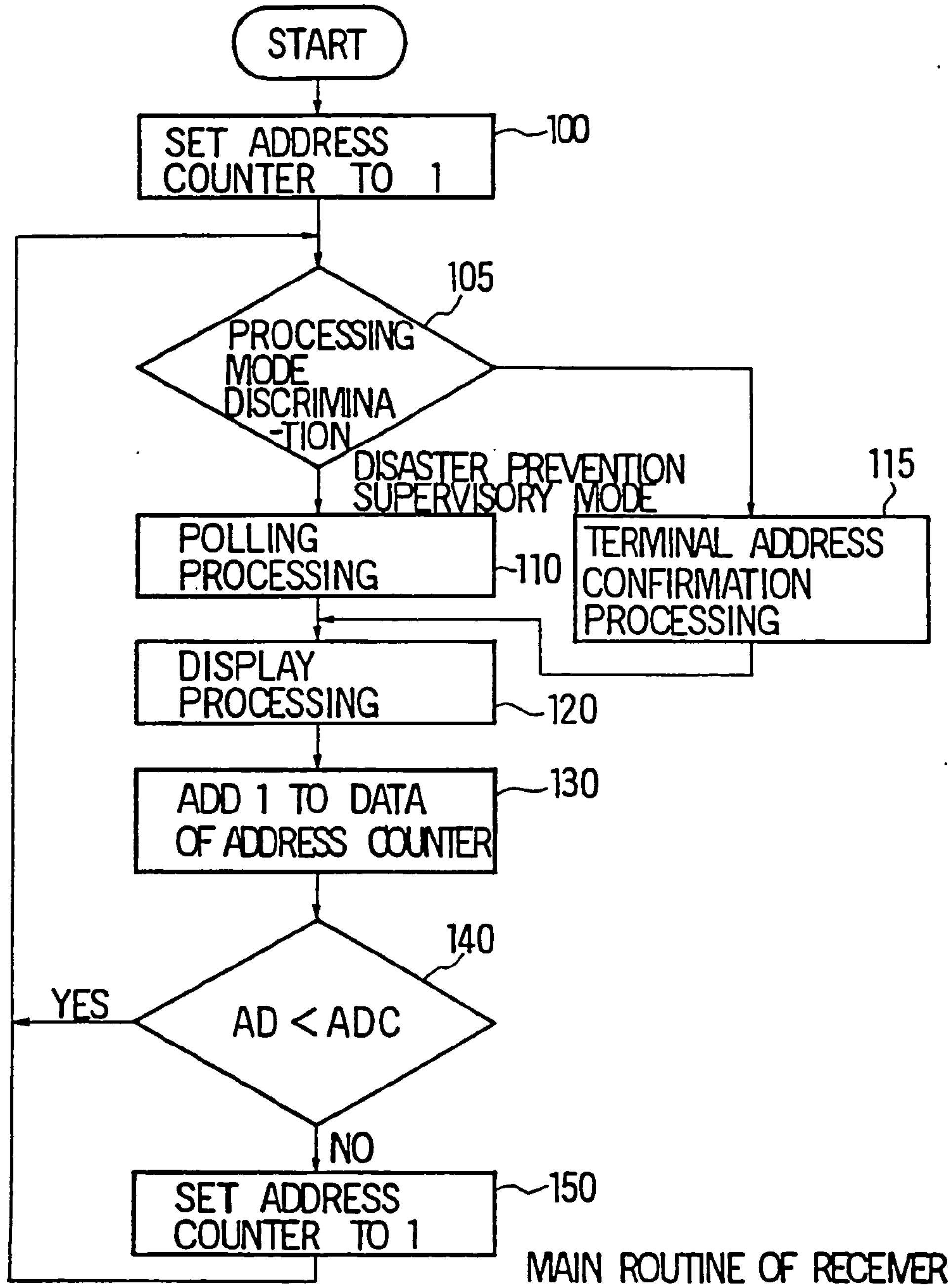
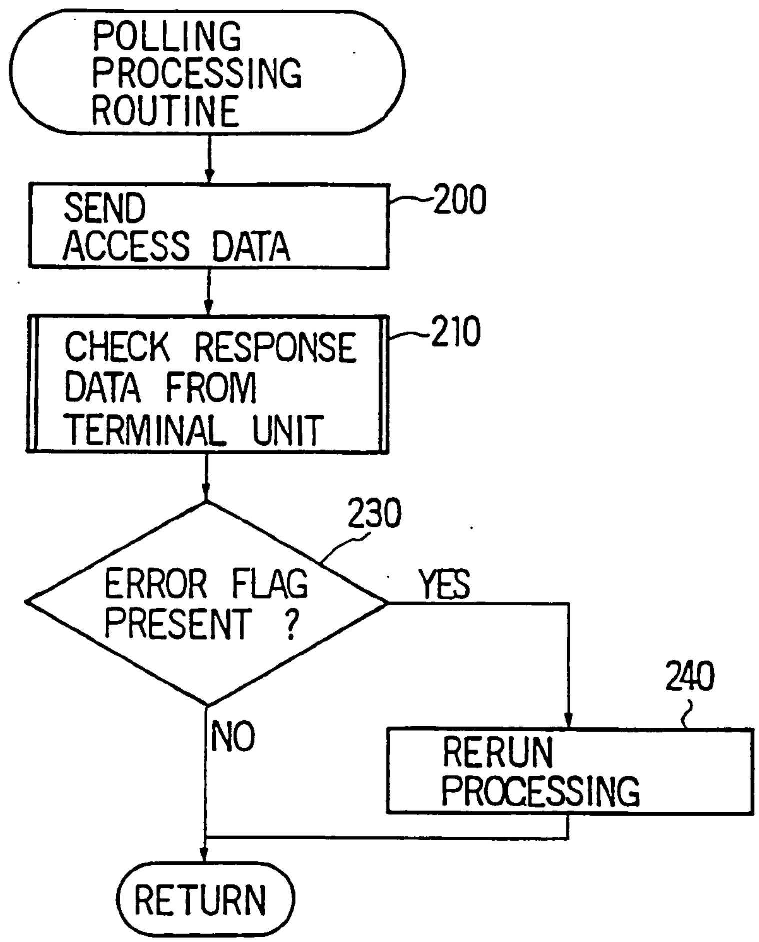
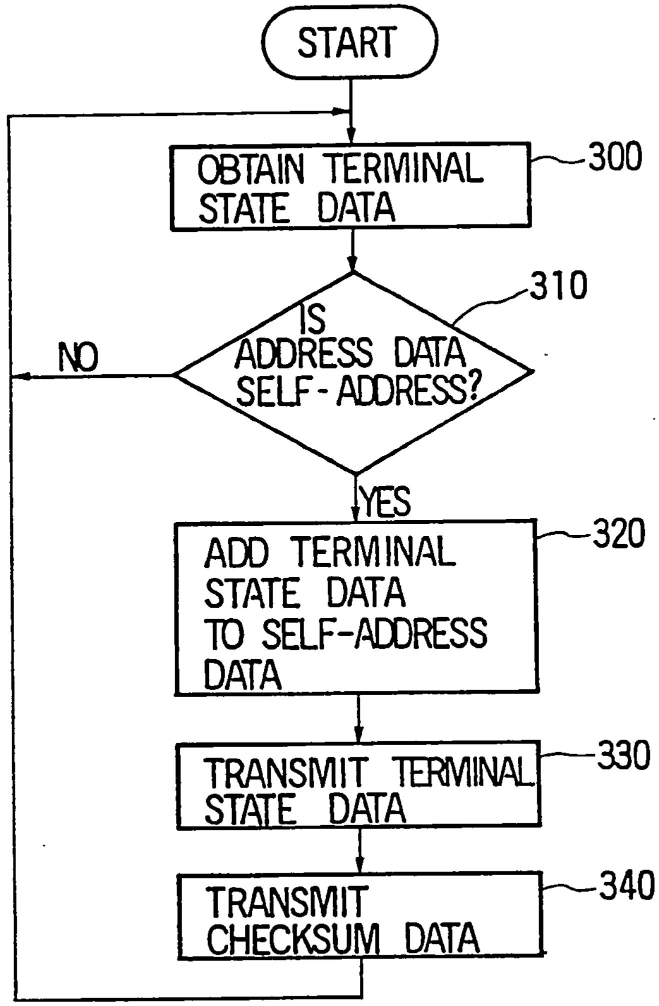

START
SET ADDRESS COUNTER TO 1
100
PROCESSING MODE DISCRIMINA -TION
105
DISASTER PREVENTION SUPERVISORY MODE
POLLING PROCESSING
110
TERMINAL ADDRESS CONFIRMATION PROCESSING
115
DISPLAY PROCESSING
120
ADD 1 TO DATA OF ADDRESS COUNTER
130
AD < ADC
140
YES
NO
SET ADDRESS COUNTER TO 1
150
MAIN ROUTINE OF RECEIVER

Fig. 4



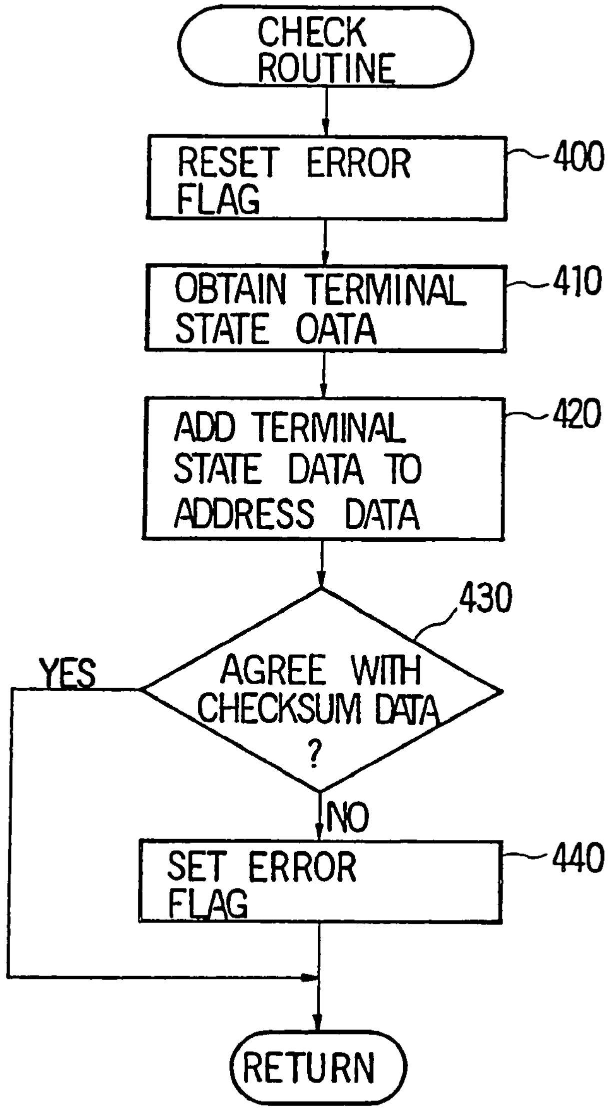
POLLING PROCESSING ROUTINE

Fig. 5



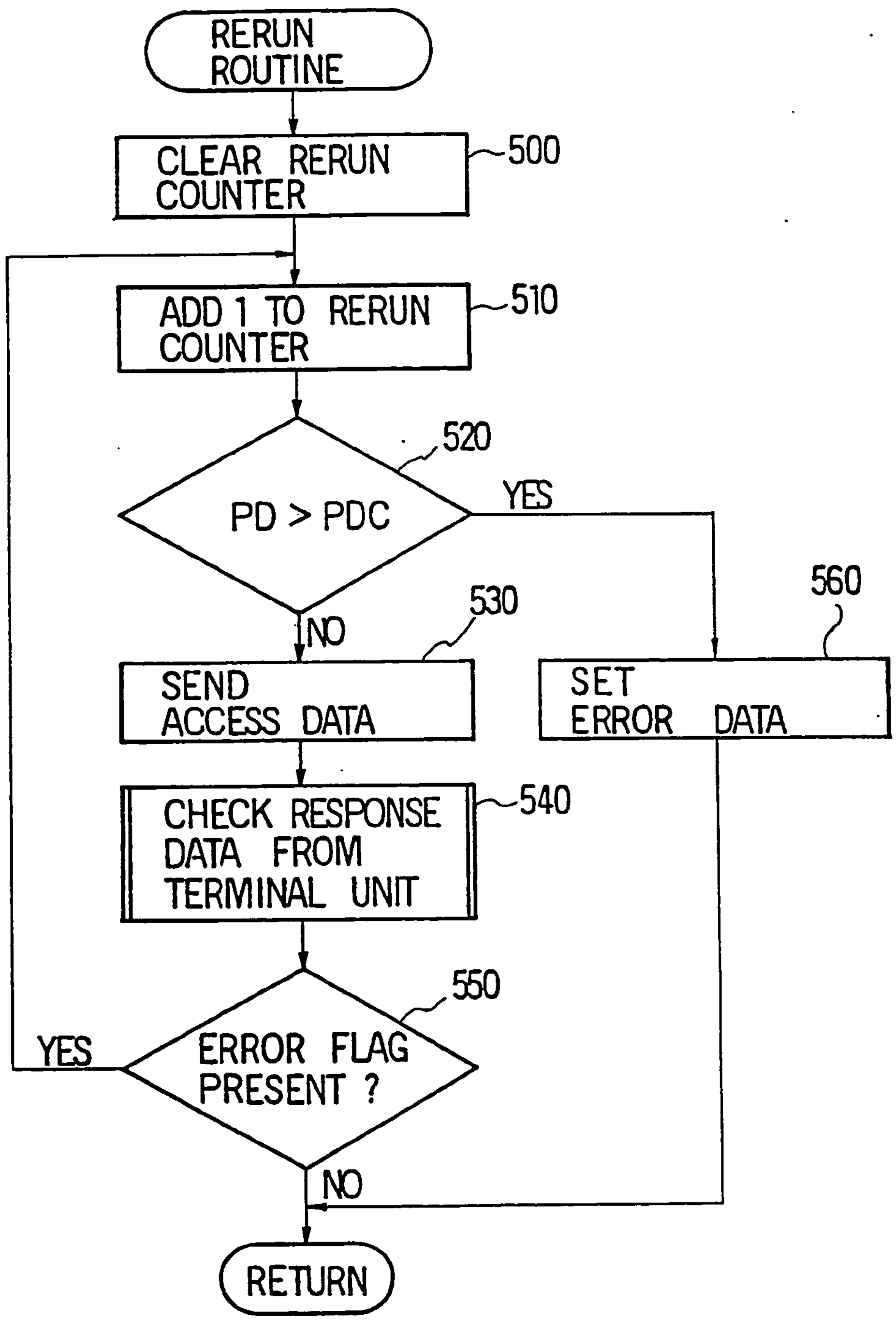
MAIN ROUTINE OF TERMINAL UNIT

Fig. 6



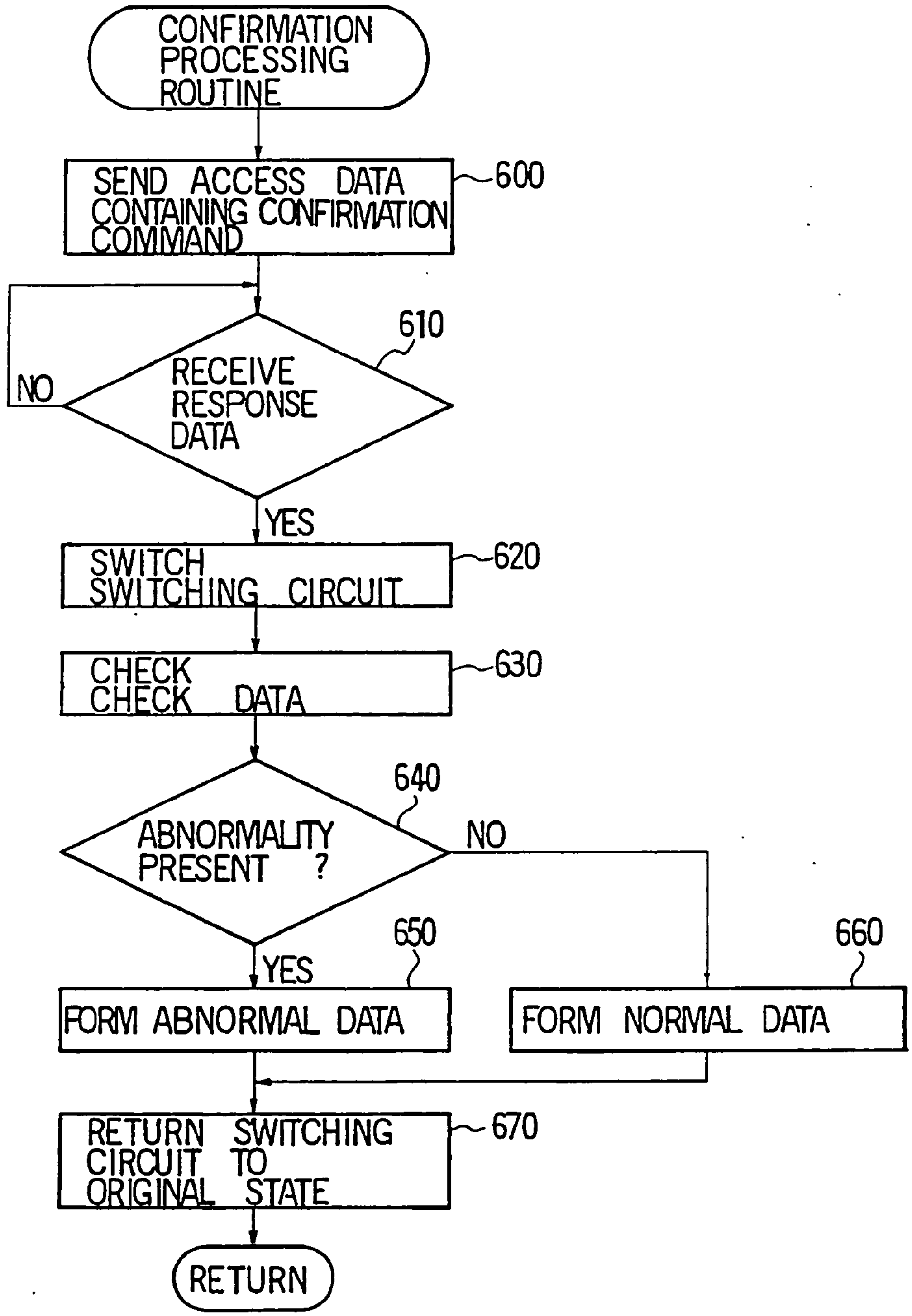
ERROR CHECK ROUTINE

Fig. 7



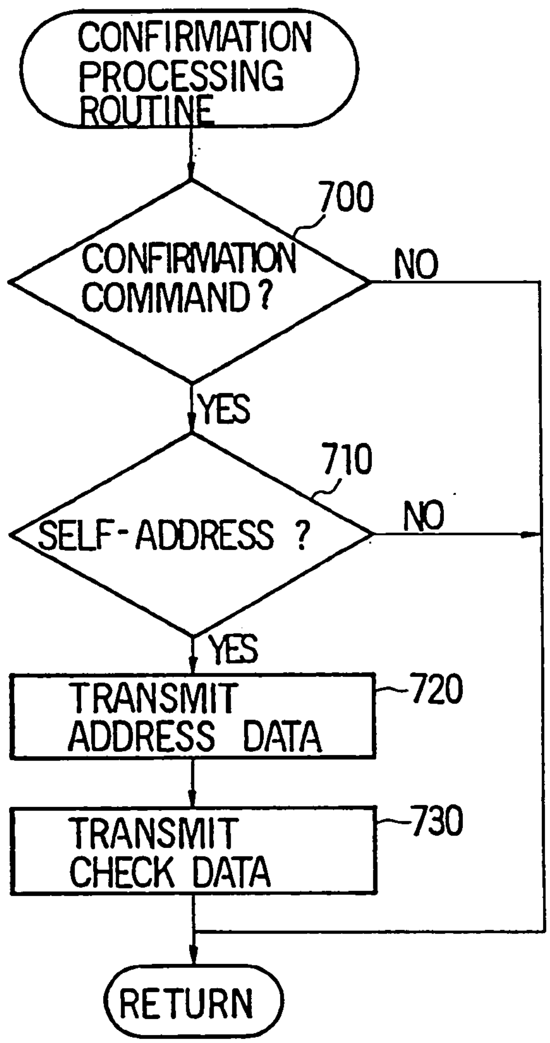
RERUN ROUTINE

Fig. 8



CONFIRMATION PROCESSING OF RECEIVER

Fig. 9



CONFIRMATION PROCESSING OF TERMINAL UNIT

Fig. 10

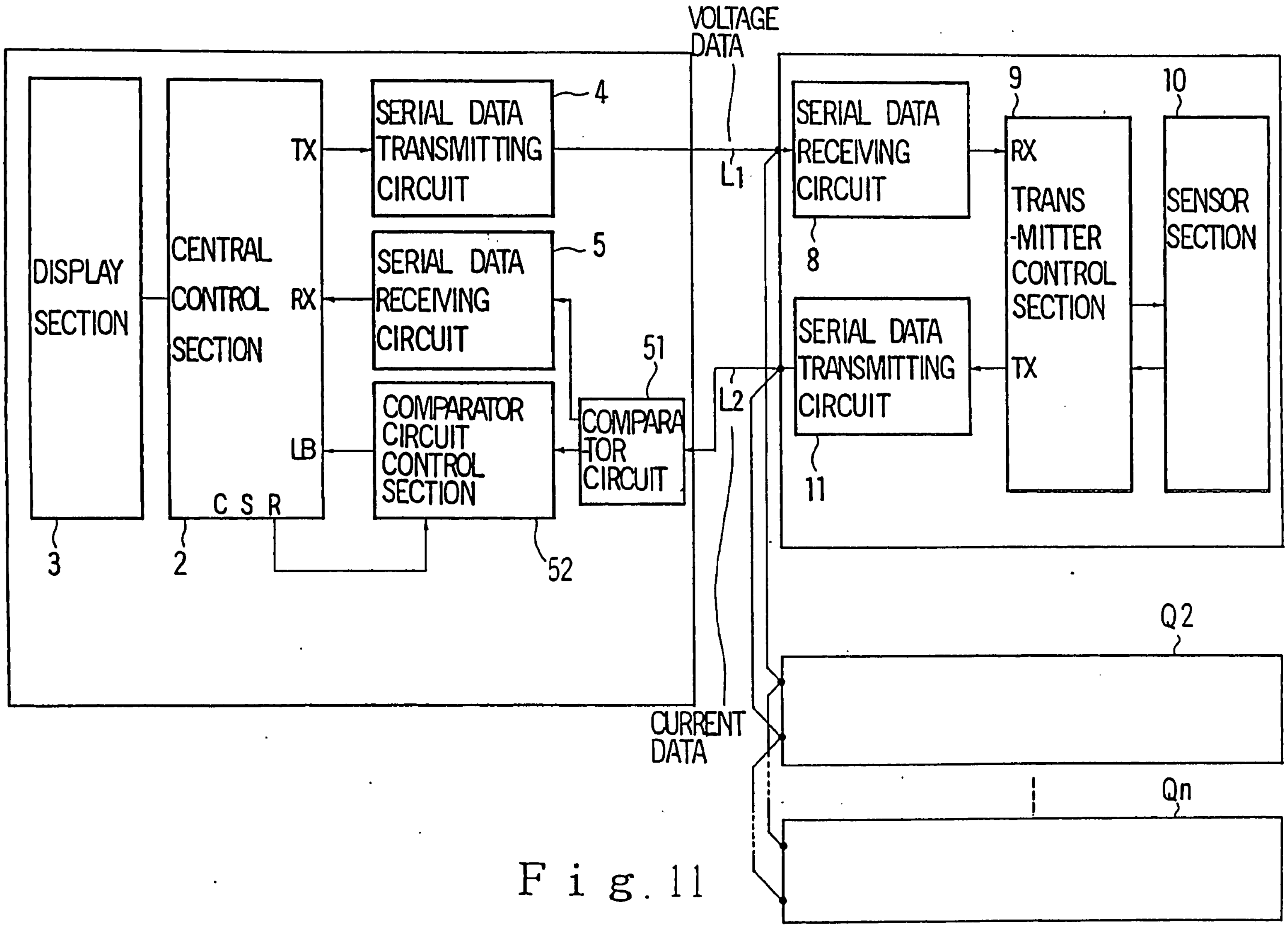

VOLTAGE DATA
DISPLAY SECTION
3
CENTRAL CONTROL SECTION
TX
RX
LB
C S R
2
SERIAL DATA TRANSMITTING CIRCUIT
4
SERIAL DATA RECEIVING CIRCUIT
5
COMPARATOR CIRCUIT CONTROL SECTION
52
COMPARATOR CIRCUIT
51
L1
L2
CURRENT DATA
SERIAL DATA RECEIVING CIRCUIT
8
SERIAL DATA TRANSMITTING CIRCUIT
11
RX
TRANS-MITTER CONTROL SECTION
TX
9
SENSOR SECTION
10
Q2
Qn

Fig. 11

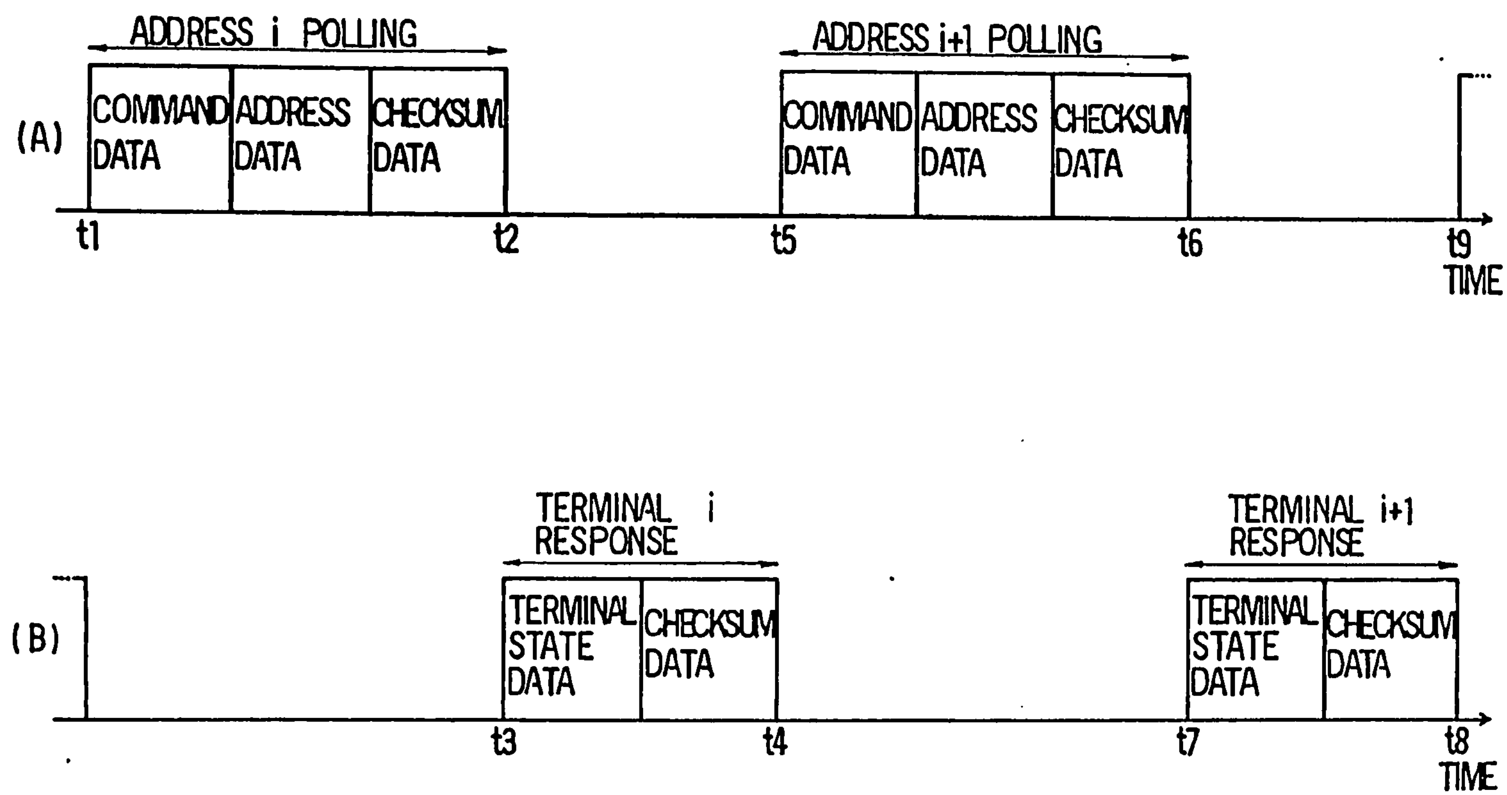
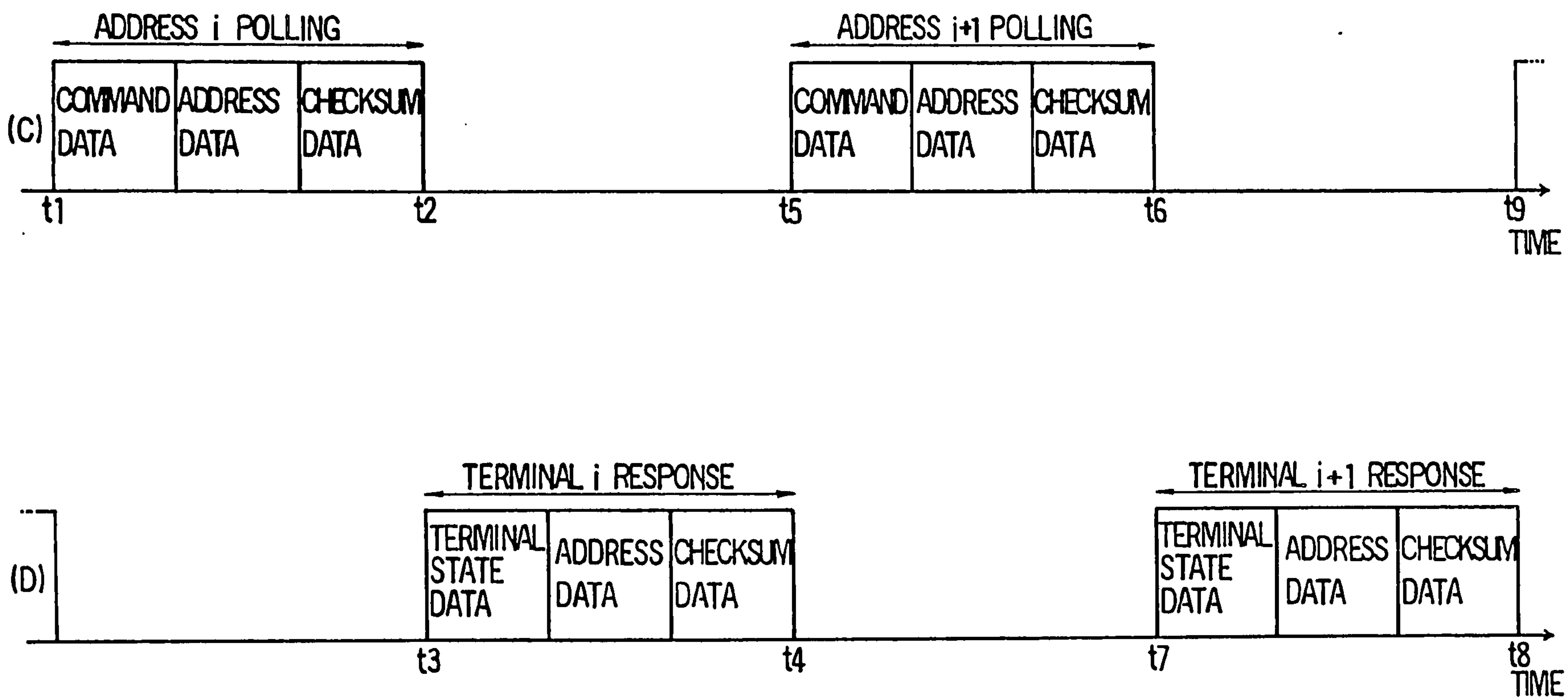

ADDRESS i POLLING
ADDRESS i+1 POLLING
(A)
COMMAND DATA
ADDRESS DATA
CHECKSUM DATA
COMMAND DATA
ADDRESS DATA
CHECKSUM DATA
t1
t2
t5
t6
t9
TIME
TERMINAL i RESPONSE
TERMINAL i+1 RESPONSE
(B)
TERMINAL STATE DATA
CHECKSUM DATA
TERMINAL STATE DATA
CHECKSUM DATA
t3
t4
t7
t8
TIME

Fig. 12(A)



ADDRESS i POLLING
ADDRESS i+1 POLLING
(C)
COMMAND DATA
ADDRESS DATA
CHECKSUM DATA
COMMAND DATA
ADDRESS DATA
CHECKSUM DATA
t1
t2
t5
t6
t9
TIME
TERMINAL i RESPONSE
TERMINAL i+1 RESPONSE
(D)
TERMINAL STATE DATA
ADDRESS DATA
CHECKSUM DATA
TERMINAL STATE DATA
ADDRESS DATA
CHECKSUM DATA
t3
t4
t7
t8
TIME

Fig. 12(B)

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DESCRIPTION

"METHOD OF DETECTING TRANSMISSION ERROR IN DISASTER PREVENTION SUPERVISORY SYSTEM"

The present invention relates to data transmission between a receiver and each of a plurality of terminal devices in a disaster prevention supervisory system such as a fire supervisory system or the like, and particularly to a method of detecting transmission error.

In a conventional disaster prevention supervisory system such as a fire supervisory system or the like, a transmission line is provided between the receiver installed in a central supervisory room or the like and each of a plurality of supervisory regions, and terminal devices such as a fire sensor, a gas sensor, a repeater and so on are connected to the transmission lines. The receiver successively calls the terminal devices by employing a so-called polling method and receives response data therefrom. This enables centralized supervision of the supervisory regions.

An example of data transmission by a conventional polling method is described below with reference to the timing charts shown in Figs. 12(A) and 12(B) of the accompanying drawings. An inherent address is first set in each of the terminal devices. As shown by points t1 to t2 in Fig. 12(A), the receiver sends calling data, including 1 byte each of command data, address data and checksum data. The terminal device i corresponding to the address data responds to this calling and returns response data, including terminal state data indicating supervisory results and checksum data, as shown by points t3 to t4 in Fig. 12(B). The same processing is repeated for the terminal device (i + 1). In this way, the receiver successively sends calling data while changing the contents

of address data so as to successively call the terminal devices and obtain the response data therefrom.

The checksum data in the calling data shown in Fig. 12(A) and sent from the receiver is added for enabling the terminal device called to detect error in the calling data and is the sum (modulo 256) of the command data and the address data. On the other hand, the checksum data in the response data shown in Fig. 12(B) and returned from each of the terminal devices is added for enabling the receiver to detect error in the response data and is the modulo 256 of the terminal state data.

Another example of transmission by a conventional polling method is described below. An inherent address is previously set in each of the terminal devices. As shown by points t1 to t2 in Fig. 12(C), the receiver sends calling data including 1 byte each of command data, address data and checksum data. The terminal device i corresponding to the address responds to this calling data and returns response data including terminal state data showing supervisory results, self-address data and checksum data, as shown by points t3 to t4 in Fig. 12(D). The same processing is performed for the terminal device (i + 1). In this way, the receiver successively sends the calling data while changing the contents of the address data so as to successively obtain supervisory information from the terminal devices in the same way as that described above.

The checksum data in the calling data shown in Fig. 12(C) is the sum (modulo 256) of the command data and the address data. The checksum data in the response data shown in Fig. 12(D) and returned from each of the terminal devices is the sum (modulo 256) of the terminal state data and the self-address data.

As described above, in each of the above transmission systems, transmission processing is performed with the timing

shown in the drawings while each of the receiver and the terminal devices analyzes the checksum data in the transmit data received and decides whether or not transmission error is present.

However, in such a method of detecting transmission error in a conventional disaster prevention supervisory system, when the same address is mistakenly set in a plurality of terminal devices during installation, servicing or the like, a plurality of terminal devices simultaneously respond to the calling data sent from the receiver. Thus the receiver cannot recognize the terminal device which returns response data, thereby producing the problem of deterioration in the reliability of the system.

For example, each of the terminal devices contains a DIP switch or the like for setting the self-address, and, during construction of a building, an installer sets the self-address of each terminal device by adjusting the DIP switch thereof when each terminal device is installed. At this time, when the same self-address is set in a plurality of terminal devices, a problem occurs. An increase in number of the terminal devices causes such a problem to easily occur and makes it very difficult to detect error.

The present invention seeks to overcome the above problems of conventional systems, and it is an object of the invention to provide a method of detecting error in a disaster prevention supervisory system which permits an increase in reliability of data transmission.

In order to achieve the object, the present invention provides a transmission error detecting method for detecting error in data transmission between a receiver and each of a plurality of terminal devices in a disaster prevention supervisory system. In the present invention, a transmission error detection mode is first set. At this time, the receiver sends calling data

including address data for specifying a specific terminal device to the side of the terminal devices. The receiver causes the terminal device specified by the address data to return error detection response data including the self-address and the check data for the current level which is previously defined. When the current level of the check data in the error detection response data received by the receiver is not equal to the range previously defined, it is decided that there is abnormality in the terminal device of the address specified by the calling data.

The receiver preferably comprises a return current level check circuit for comparing the current level of the check data in the error detection response data returned from a terminal device with the current level previously defined, a serial data receiving circuit for receiving normal data returned from a terminal device, a switching circuit for switching the return current level check circuit and the serial data receiving circuit so as to selectively switch a circuit for receiving the data returned from a terminal device and a central control section for controlling the switching circuit.

Alternatively, the receiver comprises a serial receiving circuit for receiving the data returned from a terminal device, a comparator circuit for supplying to the serial receiving circuit return data only having a current value higher than a predetermined threshold value, a comparator circuit control section for controlling the comparison circuit and a central control section for controlling the comparator circuit control section and receives the data returned from the serial receiving circuit so as to to detect transmission error and abnormality, wherein the comparator circuit has two threshold values so as to supply to the serial receiving circuit only a current higher than one of the two threshold values which is set by the comparator

circuit control section during normal receiving of return data and to supply to the serial receiving circuit only a current higher than the sum of the two threshold values in the transmission error detection mode.

In this transmission error detecting method, the receiver receives the error detection response data returned from one terminal device. Thus the current level of the check data in the error detection response data received on the receiver side is substantially equal to the current level of the check data returned from one terminal device. On the other hand, when a plurality of terminal devices which are set at the same address simultaneously respond to the calling data and return the error detection response data, the current level of the check data in the error detection response data received on the receiver side is a current level proportional to the number of the terminal devices which simultaneously respond to the calling data. Namely, the current level is higher than that in a normal case.

When a current level of the check data in the error detection response data received by the receiver side is higher than the current level previously defined, it is thus decided that an abnormality is present.

As described above, the present invention enables the reliable and rapid detection of an abnormality when error detection processing is performed for checking whether or not terminal devices are respectively installed at normal positions.

The invention is described further hereinafter, by way of example only, with reference to the accompanying drawings, wherein:

Fig. 1 is an explanatory view showing the configuration of a disaster prevention supervisory system in accordance with one embodiment of the present invention;

Fig. 2 is an explanatory view showing the format of timing of the calling data sent from a receiver and the error detection response data returned from a terminal device in an error detection mode;

Fig. 3 is an explanatory view showing the details of the error detection response data returned from a terminal device;

Fig. 4 is a flow chart showing the processing of a receiver in one embodiment;

Fig. 5 is a flow chart showing the polling processing of a receiver in one embodiment;

Fig. 6 is a flow chart showing the response processing of a terminal device in one embodiment;

Fig. 7 is a flow chart showing the error check processing of a receiver in one embodiment;

Fig. 8 is a flow chart showing the rerun processing of a receiver in one embodiment;

Fig. 9 is a flow chart showing the recognition processing by a receiver in one embodiment;

Fig.10 is a flow chart showing the recognition processing by a terminal device in one embodiment;

Fig. 11 is an explanatory view showing the configuration of a second embodiment of the present invention; and

Fig. 12 is an explanatory view showing a conventional transmission method.

The configuration of a first embodiment of a disaster prevention supervisory system in accordance with the present invention is described below with reference to Fig. 1. In Fig. 1, a receiver 1 installed in a central supervisory room or the like is connected through transmission lines L1, L2 to a plurality of terminal devices Q1 to Qn respectively installed in a plurality of supervisory regions. This system employs a so-called polling method in which the receiver 1 successively sends voltage calling data through

the transmission line L1. The terminal device corresponding to the calling data returns current response data through the transmission line L2.

The receiver 1 is provided with a central control section 2 containing a microprocessor for forming the calling data and analyzing the response data, a display section 3 for displaying a supervisory state and the like, a serial data transmitting circuit 4 for serially transmitting the calling data, a serial data receiving circuit 5 for receiving the response data returned from a terminal device, a return current level check circuit 6 which is operated for detecting error, and a switching circuit 7 for supplying the response data to the serial data receiving circuit 5 in the case of normal disaster prevention supervisory processing and for supplying the response data to the return current level check circuit 6 in the case of error detection processing.

On the other hand, a terminal device Q1 which is representative of the terminal devices, is provided with a serial data receiving circuit 8 for receiving the calling data transmitted through the transmission line L1, a transmitter control section 9 containing a microprocessor, a sensor section 10 having a detecting function to detect a fire, gas or the like, which is inherent to each of the terminal devices, and a serial data transmitting circuit 11 for returning current serial data as the response data.

In this embodiment, the following processing is performed in the case of normal disaster prevention supervisory processing:

The central control section 2 supplies calling data having a predetermined format to the serial data transmitting circuit 4 with a predetermined period. When the serial data receiving circuit 8 on the terminal device side receives time-series calling data, the serial data receiving circuit 8 extracts only the data superposed on a power source for the

terminal devices and supplies the data to the transmitter control section 9. When it is decided by the transmitter control section 9 that the section 9 itself is specified by the calling data, the response data including the terminal state data detected by the sensor section 10 and the checksum data obtained by adding the terminal state data to self-address data is supplied to the serial data transmitting circuit 11 from the control section 9. The serial data transmitting circuit 11 converts the data into time-series current response data and returns the converted data to the transmission line L2. The response data is received by the serial data receiving circuit 5 through the switching circuit 7 on the side of the receiver 1. The serial data receiving circuit 5 performs current/voltage conversion and series/parallel conversion to form response data having portions of predetermined bytes each which data is then supplied to the central control section 2. The central control section 2 makes a decision by analysis of the response data whether or not an abnormality is present in the supervisory regions.

On the other hand, when error detection processing is performed for checking whether or not the terminal devices are respectively installed at normal positions, the following processing is executed:

The central control section 2 supplies calling data for instructing the error detection processing to the serial data transmitting circuit 4 with a predetermined period. The serial data transmitting circuit 4 converts the calling data into time series data and sends the data to the transmission line L1. When the transmitter control section 9 of the terminal device corresponding to the calling data decides that the self address of the section 9 is specified, the transmitter control section 9 supplies the error detection response data formed according to a predetermined format to

the serial data transmitting circuit 11. The serial data transmitting circuit 11 converts the data into time-series current data and returns the data to the transmission line L2. The return current level check circuit 6 receives the error detection response data through the switching circuit 7 on the side of the receiver 1. When the results of predetermined error detection processing for the error detection response data are supplied to the central control section 2, the presence of an abnormality in the installation of the terminal devices is detected.

The switching circuit 7 is switched in accordance with the switching control signal output from the terminal C of the central control section 2. The return current check circuit 6 is operated in accordance with the control signal and the synchronizing signal which are respectively output from the terminals S, R of the central control section 2.

The format of calling data sent for each period from the receiver 1 has 1-byte command data, 1-byte address data and 1-byte checksum data.

The command data serves as supervisory command data having a predetermined binary code in the disaster prevention supervisory mode in which each of the terminal devices is required for returning response data, for example, with respect to disaster prevention supervision. The address data is data having a binary code for specifying the address inherent to each of the terminal devices while being changed for each period. The checksum data is the sum (modulo 256) of the command data and the address data.

While in the error detection mode for checking whether or not the terminal devices are respectively installed at predetermined positions with normal addresses, the command data shown in Fig. 2(A) has a predetermined data code for instructing the error detection processing. The address data is changed for each period so as to serve as data having

a binary code for specifying the address inherent to each of the terminal devices, and the checksum data is the sum (modulo 256) of the command data and the address data.

In the disaster prevention supervisory mode, the format of the response data returned from each of the terminal device comprises 1-byte terminal state data and 1-byte checksum data, like the format shown in Fig. 12(B). The terminal specified by the address data in the calling data returns the response data. As described above, the checksum data in the response data is formed by adding the terminal state data to the self-address data of each of the terminal devices.

While in the error detection mode, the format of the error detection response data comprises 1-byte self-address data showing self-address and subsequent 1-byte check data, as shown in Fig. 2(B). The check data has a front portion of 4 bits set at a theoretical value "0" and the remainder of 4 bits set at a theoretical value "1", as shown in Fig. 3(A). The current difference between the theoretical values "0" and "1" is set as a predetermined current value IC.

The operation of this embodiment is described below on the basis of the flow charts shown in Figs. 4 to 10.

A description is first made of the case in which, when the operator gives instructions for disaster supervision to the receiver 1, the central control section 2 controls in the disaster prevention supervisory mode.

In Step 100, an address counter is first set to the address of a terminal device to be specified by the central control section 2 of the receiver 1. If it is decided in Step 105 that the disaster prevention supervisory mode is instructed, in Step 110, polling processing is performed for the terminal device of the address set in the address counter.

In the polling processing, in Step 200, the receiver 1 sends the calling data including the command data, the address data set in the address counter and the checksum data through the transmission line L1, as shown in Fig. 5.

On the other hand, each of the terminal devices under polling processing is operated in accordance with the flow chart shown in Fig. 6. The response data output from the terminal device which responds to the calling data is received by the receiver 1. As shown in Fig. 6, in Step 300, the transmitter control section 9 of each of the terminal devices obtains the terminal state data showing the conditions in the supervisory region detected by the sensor section 10. In Step 310, the transmitter control section 9 is in a stand-by state until the address data in the calling data agrees with the self address. When the address data in the calling data agrees with the self address, in Step 320, the transmitter control section 9 adds the terminal state data to the self-address data to form the checksum data. In Steps 330 and 340, the serial data transmitting circuit 11 then sends the response data to the transmission line L2 in the order of the terminal state data and the checksum data.

A description is made with reference to Fig. 5. In Step 210, when the response data returned in response to the calling data is received, error in the response data is checked.

The error is checked in accordance with the processing shown in Fig. 7. In Fig. 7, in Step 400, the response data error flag contained in the central control section 2 is reset, and in Step 410, the terminal state data of the response data is input to an operating section. In Step 420, the address data of the address counter is then added to the terminal state data. In Step 430, a decision is made as to whether or not the data determined by the addition agrees with the checksum data in the response data. If the data

agrees with the checksum data, it is decided that no error is present in the response data. while if the data does not agree with the checksum data, it is decided that error has occurred, and in Step 440, the response data error flag is set. Only when error is detected, is the error flag set.

When the processing in the response data check routine is completed, the processing moves to Step 230 shown in Fig. 5. In Step 230, a decision is made as to whether or not the response data error flag is set. If the error flag is not set, the processing moves directly to Step 120 shown in Fig. 4, while if the error flag is set, the rerun processing in Step 240 is performed, and the processing then moves to Step 120.

The rerun processing in Step 240 is performed in accordance with the rerun routine shown in Fig. 8.

In Step 500 shown in Fig. 8, the rerun counter in the central control section 2 is first cleared. In Step 510, 1 is then added to the data in the rerun counter. In Step 520, a decision is made as to whether or not the data value PD of the rerun counter exceeds a predetermined number PDC of reruns. If the data value PD does not exceed the predetermined rerun number PDC, the processing moves to Step 530 in which calling data containing the same address data is sent to the side of the terminal devices through the transmission line L2. The response data from the terminal device which responds to the calling data is received in Step 540.

In Step 540, processing is performed in accordance with the same check routine as that shown in Fig. 7. If it is decided in Step 440 shown in Fig. 7 that the error flag is not set, the response data is normal, while if the error flag is set, it is decided that error is again detected in the response data.

In Step 550, the presence of the error flag is detected. If the error flag is again set, the rerun processing from Step 510 to Step 550 is repeated until no error flag is detected in Step 550.

If it is decided in Step 520 that transmission error is not removed by repeating a predetermined number PDC of rerun processing, the processing moves to Step 560. In Step 560, display data showing the occurrence of transmission error is set, and the processing returns to the polling processing in Step 110 shown in Fig. 4.

In this way, when the polling processing in Step 110 shown in Fig. 4 is completed for one terminal device, in Step 120, the display section 3 displays the supervisory conditions of the supervisory region corresponding to the response data output from the terminal device and, if transmission error occurs, the display sections 3 displays the error.

In Step 130, 1 is then added to the address counter for specifying the next terminal device. In Step 140, a decision is made as to whether or not the data value AD exceeds the final address ADC of the terminal devices. When the data value AD does not yet exceed the final address ADC, the processing from Step 105 to Step 140 is repeated for polling processing for the next terminal device. When it is decided in Step 140 that the data value AD exceeds the final address ADC of the terminal devices, the content of the address counter is reset to 1 in Step 150, and the processing from Step 105 to Step 140 is then repeated. This causes the polling processing to be performed again for the first terminal device.

In this way, in the normal disaster prevention supervisory mode, the response data returned from each of the terminal devices includes the terminal state data and the checksum data obtained by adding the terminal state data to

the self-address data. The address data is added to the terminal state data on the side of the receiver 1. In this case, when the data obtained by the addition does not agree with the checksum data, it is decided that transmission error is present. It is therefore possible to reliably detect the terminal device which is producing transmission error. The length of the response data is short even if the data includes the self-address data. It is thus possible to perform the polling processing at a high speed.

A description is now be made of the operation in the error detection mode.

When the operator gives instructions for error detection processing to the receiver 1, a decision is made in Step 105 shown in Fig. 4 as to whether or not the error detection mode is set, and the processing then moves to terminal address confirmation processing in Step 115.

The processing in Step 115 includes the processing shown in Fig. 9 performed on the side of the receiver 1 and the processing shown in Fig. 10 performed on the side of the terminal devices.

In Step 600 shown in Fig. 9, the receiver 1 first sends to the transmission line L1 calling data including recognition command for instructing error detection, the address data as the data of the address counter and checksum data.

A terminal device performs the response processing shown in Fig. 10 in response to the calling data. In Step 700 shown in Fig. 10, when the transmitter control section 9 decides that the recognition command data is set, in Step 710, a decision is made as to whether or not the the address data agrees with the self address. If it is decided that the self address is specified, in Steps 720 and 730, the error detection response data including the self-address data and the checksum data is supplied to the serial data

transmitting circuit 11 in response to the result of the decision. The serial data transmitting circuit 11 returns the error detection response data to the transmission line L2 after parallel/series conversion into time series current data.

On the other hand, the receiver 9 performs the processing in Step 610 shown in Fig. 9 and assumes a stand-by state until the error detection response data is returned. When it is recognized that the response data is received, in Step 620, the switching circuit 7 is switched so that the transmission line L2 is connected to the return current level check circuit 6.

In Step 630, the return current level check circuit 6 compares the current value IR of a portion at the theoretical value "1" in the check data with the internal reference current value IC with predetermined timing. In Step 640, the result of comparison is input to the central control section 2 which then decides whether or not an abnormality is present.

Namely, in a normal state without error, the error detection response data is received from only one terminal device. The current value IR is thus substantially equal to the current value IC of the check data shown in Fig. 3(A) sent from the terminal device side. At this time, it is decided that an abnormality is absent for the terminal device specified by the calling data sent from the side of the receiver 1.

On the other hand, when a plurality of terminal devices which are set to the same address simultaneously respond to the calling data and return the error detection response data, for example, as shown in Fig. 3(B), the current value IR of a portion at the theoretical value "1" in the check data is a value of N x IC which is proportional to the number N of the terminal devices which simultaneously respond.

Since the relation, IR > IC, is thus established, it is decided that an abnormality is present.

When it is decided that an abnormality is present, the processing moves to Step 650. In this case, abnormal data for indicating the presence of an abnormality for the addressed terminal device is formed.

While when it is decided that no abnormality is present, in Step 660, normal data for indicating the absence of an abnormality for the addressed terminal device is formed. In Step 670, the switching circuit 7 is then switched so that the serial data transmitting circuit 5 is connected to the transmission line L2, and the processing in Step 115 shown in Fig. 4 is completed.

The abnormal data or the normal data formed in Step 650 or 660 is displayed on the display section 3 in Step 120.

In Step 140, the address counter is then set to the address of the next terminal device to be called. If the address of the terminal device to be called is not the final address, the processing is repeated from Step 105 through the processing in Steps 140 and 150.

In this way, as shown in Figs. 3(A) and 3(B), in the error detection mode, each of the terminal device returns the error detection response data having a predetermined format, and the current value of a portion corresponding to the check data in the error detection response data is detected on the side of the receiver 1. A decision is then made as to whether or not each of the terminal devices is set to a predetermined address. It is thus possible to rapidly and reliably detect an abnormality.

In addition, the check data in the error detection response data comprises a low-frequency square signal having the portions each respectively set at the theoretical values "0" and "1", as shown in Fig. 3(A). The return current level check circuit 6 is thus capable of reliable strobing in

synchronism with the portion set at the theoretical value of "1". It is therefor possible to improve the degree of freedom of design and the reliability of data transmission.

A second embodiment of the present invention is described below. In the second embodiment, the configuration of the receiver in the first embodiment is simplified, as shown in Fig. 11.

In this embodiment, a receiver 1 comprises a central control section 2 containing a microprocessor for forming calling data and analyzing response data, a display section 3 for displaying supervisory conditions and the like, a serial data transmitting circuit 4 for serially transmitting the calling data, a serial data receiving circuit 5 for receiving the response data returned from each of terminal devices, a comparator circuit 51 for comparing the current value of the response data sent from each of the terminal devices with a predetermined threshold value previously set and a comparator circuit control section 52 for controlling the comparator circuit 51.

In the comparator circuit 51 are previously set two threshold values, for example, 9 mA and 30 mA. The comparator circuit control section 52 selects and sets one of the two threshold values according to the instructions from the central control section 2. The comparator circuit 51 sends the current only higher than the set threshold value to the serial data receiving circuit 5.

In this embodiment, in normal disaster prevention supervisory processing, the comparator circuit control section 52 sets the threshold value of 9 mA among the above examples of threshold values. The threshold value is set in the comparator circuit 51 even in normal processing in order to remove the effects of the noise component contained in the return data. Since normal return data is returned with a current of about 20 mA, the return data is thus supplied to

the central control section 2 without being damaged even if the noise component is removed.

On the other hand, in the case of error detection processing, the comparator circuit control section 52 sets as a threshold value 39 mA which is the sum of 9 mA and 30 mA. Data only having a current value higher than 39 mA is thus supplied to the central control section 2. Since the return data is returned with a current of 20 mA from each of the terminal devices, when only one terminal device responds, the current is cut by the comparator circuit 51 and is not supplied to the central control section 2. However, when two or more terminal devices respond, since the current of the return data is 40 mA or more which is higher than the threshold value of 39 mA, the data is supplied to the central control section 2. When the return data is supplied to the central control section 2 after the calling data is sent, it is decided that an abnormality is present.

The present invention configured as described above enables reliable detection of error and simplification of the structure of the receiver.

In the above embodiment, two threshold values are set previously, such as 9mA and 39mA,and the data with less than 9mA is cut as a noise component, while in the case of the data with more than 39mA it is decided that an abnormality is present. However, it is possible to set the range, such as 9 — 39mA to decide an abnormality. It is decided that a normality is present when said range data is received and that an abnormality is present when the data is higher than that range.

CLAIMS

1. A transmission error detecting method for detecting error in data transmission between a receiver and each of a plurality of terminal devices in a disaster prevention supervisory system, wherein:

in a transmission error detection mode, said receiver sends calling data including address data for specifying a specific terminal device and causes the terminal device specified by said address data to return error detection response data including self-address data and check data at a predefined current level, and when the current level of said check data in said error detection response data received by said receiver is not equal to, or within a predetermined range of, said predefined current, it is decided that an abnormality is present.

2. A receiver for use in the method, according to claim 1, comprising a return current level check circuit for comparing the current level of check data in the error detection response data returned from each of said terminal devices, a serial data receiving circuit for receiving normal return data output from each of said terminal devices, a switching circuit for switching said return current level check circuit and said serial data receiving circuit so as to selectively switch a circuit for receiving the return data from each of said terminal devices and a central control section for controlling said switching circuit.

3. A receiver for use in the method according to claim 1, comprising a serial receiving circuit for receiving return data output from each of terminal

devices, a comparator circuit for supplying to said serial receiving circuit return data only having a current value higher than a predetermined threshold value, a comparator circuit control section for controlling said comparator circuit, and a central control section for controlling said comparator circuit control section and receiving the data returned from said serial receiving circuit so as to detect transmission error and an abnormality, wherein:

said comparator circuit has two threshold values so as to supply a current only higher than one of said two threshold values, which is set by said comparator circuit control section, during normal return data receiving, and supply a current only higher than the sum of said two threshold values in a transmission error detection mode, to said serial receiving circuit.

4. A disaster prevention supervisory system , including a means for detecting error in data transmission between a receiver and each of a plurality of terminal devices and wherein, in a transmission error detection mode, said receiver is adapted to send calling data, including address data for specifying a specific terminal device, and the terminal device specified by said address data is adapted to return error detection response data, including self-address data and check data, at a predefined current level, and means which responds to the current level of said check data in said error detection response data received by said receiver being unequal to, or outside within a predetermined range from, said predefined current level to decide that an abnormality is present.

5. A system according to claim 4, comprising a return current level check circuit for comparing the current level of check data in the error detection response data returned from each of said terminal devices, a serial data receiving circuit for receiving normal return data output from each of said terminal devices, a switching circuit for switching said return current level check circuit and said serial data receiving circuit so as to selectively switch a circuit for receiving the return data from each of said terminal devices, and a central control section for controlling said switching circuit.

6. A system according to claim 4, comprising a serial receiving circuit for receiving return data output from each cf terminal devices, a comparator circuit for supplying to said serial receiving circuit return data only having a current value higher than a predetermined threshold value, a comparator circuit control section for controlling said comparator circuit, and a central control section for controlling said comparator circuit control section and receiving the data returned from said serial receiving circuit so as to detect transmission error and an abnormality, wherein:

said comparator circuit has two threshold values so as to supply a current only higher than one of said two threshold values, which is set by said comparator circuit control section, during normal return data receiving, and supply a current only higher than the sum of said two threshold values in a transmission error detection mode, to said serial receiving circuit.

7. A transmission error detecting method, substantially as hereinbefore described, with reference to Figures 1-11 of the accompanying drawings.

8. A disaster prevention supervisory system, substantially as hereinbefore described, with reference to and as illustrated in Figures 1-11 of the accompanying drawings.

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Databases (see over)

(i) UK Patent Office

(ii)

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Documents considered relevant following a search in respect of claims 1-6

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
A	GB 2106358 A (HEWLETT-PACKARD) - see whole specification	1,4
A	US 4962368 (GENERAL SIGNAL) - see Columns 6 to 8	1,4
A	US 4901316 (NOHMI BOSAI KOGYO) - see Column 1, lines 25-29 and EP 0247862	1,4

Category	Identity of document and relevant passages	Relevant to claim(s)

Categories of documents

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